We claim:

1. Apparatus for processing a fluid stream, comprising:

a heat exchanger having first and second spaced-apart walls that define an inlet passage and an outlet passage for the fluid stream, wherein the walls are configured to transfer heat from the outlet passage to the inlet passage; and

a diesel particulate filter integrally connected to the heat exchanger and positioned to transmit the fluid stream from the inlet passage to the outlet passage, wherein the diesel particulate filter is configured to oxidize carbon monoxide and hydrocarbons, and to collect and oxidize particulate matter present in the fluid stream.

2. The apparatus of claim 1, wherein the diesel particulate filter is a ceramic wall-flow particulate filter.

3. The apparatus of claim 1, wherein the diesel particulate filter comprises a material selected from the group consisting of ceramic foam, sintered metal foam, and ceramic fiber yarn.

4. The apparatus of claim 1, wherein the diesel particulate filter comprises a catalyst.

5. The apparatus of claim 4, wherein the catalyst comprises a material selected from the group of platinum, palladium, and ceramic oxide.

6. The apparatus of claim 1, and further comprising a lean-NOx catalyst located upstream of the diesel particulate filter, wherein the lean-NOx catalyst is configured to reduce nitrogen oxides present in the fluid stream.

7. The apparatus of claim 6, wherein the lean-NOx catalyst is located immediately adjacent to the diesel particulate filter.

8. The apparatus of claim 7, wherein:

the diesel particulate filter has a surface facing the inlet passage; and

wherein the lean-NOx catalyst is deposited on the surface of the diesel particulate filter facing the inlet passage.

9. The apparatus of claim 6, wherein the lean-NOx catalyst has a monolithic structure.

10. The apparatus of claim 6, wherein the lean-NOx catalyst is comprised of a material selected from the group consisting of precious metal, ceramic foam, and metal foam.

11. The apparatus of claim 1, and further comprising a diesel oxidation catalyst integrally connected to the heat exchanger, between the inlet and outlet passage, wherein the diesel oxidation catalyst is configured to oxidize carbon monoxide and hydrocarbons present in the fluid stream.

12. The apparatus of claim 10, wherein the diesel oxidation catalyst comprises metal.

13. The apparatus of claim 10, wherein the diesel oxidation catalyst comprises ceramic foam or metal foam.

14. The apparatus of claim 1, and further comprising a fuel injector located and configured to inject hydrocarbons into the inlet passage.

15. The apparatus of claim 14, and further comprising:

one or more pressure sensors configured to produce a pressure signal indicative of any pressure drop through the diesel particulate filter;

a temperature sensor configured to produce a temperature signal, indicative of the temperature at a predetermined position adjacent to the diesel particulate filter; and

a controller, responsive to the pressure signal and the temperature signal, for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage.

16. The apparatus of claim 15, wherein the controller is selected to maintain the pressure drop through the diesel particulate filter at or below a specified level.

17. The apparatus of claim 15, wherein the controller is selected to maintain the temperature at a predetermined position adjacent to the diesel particulate filter at or below a specified level.

18. The apparatus of claim 15, wherein:

the fluid stream is the exhaust from an engine;

the engine comprises an engine speed sensor configured to produce an engine speed signal indicative of the engine's speed; and

the controller is responsive to the engine speed signal for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage.

19. The apparatus of claim 1, and further comprising a resistance heater configured to heat the fluid stream in the inlet passage.

20. The apparatus of claim 1, wherein the first and second spaced-apart walls have a spiral configuration.

21. Apparatus for processing a fluid stream, comprising:

a heat exchanger having first and second spaced-apart walls that define an inlet passage and an outlet passage for the fluid stream, wherein the walls are configured to transfer heat from the outlet passage to the inlet passage; and

a diesel oxidation catalyst integrally connected to the heat exchanger, between the inlet and outlet passage, wherein the diesel oxidation catalyst is configured to oxidize carbon monoxide and hydrocarbons in the fluid stream; and

a lean-NOx catalyst located upstream of the diesel oxidation catalyst, wherein the lean-NOx catalyst is configured to reduce nitrogen oxides in the stream.

22. The apparatus of claim 21, wherein the diesel oxidation catalyst comprises metal.

23. The apparatus of claim 21, wherein the diesel oxidation catalyst comprises ceramic foam or metal foam.

24. The apparatus of claim 21, wherein the lean-NOx catalyst is located immediately adjacent to the diesel oxidation catalyst.

25. The apparatus of claim 24, wherein:

the diesel oxidation catalyst has a surface facing the inlet passage; and

wherein the lean-NOx catalyst is deposited on the surface of the diesel oxidation catalyst facing the inlet passage.

26. The apparatus of claim 21, wherein the lean-NOx catalyst has a monolithic structure.

27. The apparatus of claim 21, wherein the lean-NOx catalyst is comprised of a material selected from the group consisting of precious metal, ceramic foam, and metal foam.

28. The apparatus of claim 21, and further comprising a fuel injector located and configured to inject hydrocarbons into the inlet passage.

29. The apparatus of claim 28 and further comprising:

a temperature sensor configured to produce a temperature signal, indicative of the temperature at a predetermined position adjacent to the diesel oxidation catalyst and

a controller, responsive to the temperature signal, for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage.

30. The apparatus of claim 29, wherein the controller is selected to maintain the temperature at a predetermined position adjacent to the diesel oxidation catalyst at or below a specified level.

31. The apparatus of claim 29, wherein:

the fluid stream is the exhaust from an engine;

the engine comprises an engine speed sensor configured to produce an engine speed signal indicative of the engine's speed; and

the controller is responsive to the engine speed signal for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage.

32. The apparatus of claim 21, and further comprising a resistance heater configured to heat the fluid stream in the inlet passage.

33. The apparatus of claim 21, wherein the first and second spaced-apart walls have a spiral configuration.

34. Apparatus for processing a fluid stream, comprising:

a heat exchanger having first and second spaced-apart walls that define an inlet passage and an outlet passage for the fluid stream, wherein the walls are configured to transfer heat from the outlet passage to the inlet passage;

a diesel particulate filter integrally connected to the heat exchanger and positioned to transmit the fluid stream from the inlet passage to the outlet passage, wherein the diesel particulate filter is configured to oxidize carbon monoxide and hydrocarbons, and to collect and oxidize particulate matter present in the fluid stream;

a diesel oxidation catalyst integrally connected to the heat exchanger, between the inlet and outlet passage, wherein the diesel oxidation catalyst is configured to oxidize carbon monoxide and hydrocarbons present in the fluid stream;

a lean-NOx catalyst located upstream of the diesel particulate filter, wherein the lean-NOx catalyst is configured to reduce nitrogen oxides present in the fluid stream;

a fuel injector located and configured to inject hydrocarbons into the inlet passage;

one or more pressure sensors configured to produce a pressure signal indicative of any pressure drop through the diesel particulate filter;

a temperature sensor configured to produce a temperature signal, indicative of the temperature at a predetermined position adjacent to the diesel particulate filter;

a controller, responsive to the pressure signal and the temperature signal, for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage;

wherein the controller is selected to maintain the pressure drop through the diesel particulate filter at or below a specified level, and to maintain the temperature at a predetermined position within the diesel particulate filter at or below a specified level; and

a resistance heater configured to heat the fluid stream in the inlet passage.

35. The apparatus of claim 34, wherein:

the fluid stream is the exhaust from an engine;

the engine comprises an engine speed sensor configured to produce an engine speed signal indicative of the engine's speed; and

the controller is responsive to the engine speed signal for controlling the rate at which the fuel injector injects hydrocarbons into the inlet passage.

36. A method for processing a fluid stream, comprising:

preheating the fluid stream by heat exchange using an exiting treated fluid stream; and

oxidizing carbon monoxide and hydrocarbons, and collecting and oxidizing particulate matter in the preheated fluid stream, to produce the exiting treated fluid stream.

37. The method of claim 36, wherein oxidizing carbon monoxide and hydrocarbons, and collecting and oxidizing particulate matter present in the preheated fluid stream is performed using a diesel particulate filter.

38. The method of claim 36, wherein oxidizing carbon monoxide and hydrocarbons present in the preheated fluid stream is performed using a diesel oxidation catalyst.

39. The method of claim 36, and further comprising reducing nitrogen oxides present in the preheated fluid stream.

40. The method of claim 39, wherein reducing nitrogen oxides present in the preheated fluid stream is performed using a lean-NOx catalyst.

41. The method of claim 36, and further comprising injecting hydrocarbon into the preheated fluid stream.

42. The method of claim 41, wherein injecting hydrocarbon into the preheated fluid stream comprises:

measuring the temperature at a point in the preheated fluid stream; and

controlling the rate at which hydrocarbon is injected into the preheated fluid stream based upon the measured temperature.

43. The method of claim 41, wherein injecting hydrocarbon into the preheated fluid stream comprises:

measuring the pressure at points in the preheated fluid stream; and

controlling the rate at which hydrocarbon is injected into the preheated fluid stream based upon the measured pressures.

44. The method of claim 41, wherein the preheated fluid stream is the exhaust from an engine, and further comprising:

measuring the speed of the engine; and

controlling the rate at which hydrocarbon is injected into the preheated fluid stream based upon the measured engine speed.

45. The method of claim 36, and further comprising preheating the fluid stream using an external heat source prior to preheating using the exiting treated fluid stream.

46. A method for processing a fluid stream, comprising:

preheating the fluid stream by heat exchange using an exiting treated fluid stream; and

oxidizing carbon monoxide and hydrocarbons, and reducing nitrogen oxides present in the preheated fluid stream, to produce the exiting treated fluid stream.

47. The method of claim 46, wherein oxidizing carbon monoxide and hydrocarbons present in the preheated fluid stream is performed using a diesel oxidation catalyst.

48. The method of claim 46, wherein reducing nitrogen oxides present in the preheated fluid stream is performed using a lean-NOx catalyst.

49. The method of claim 46, and further comprising injecting hydrocarbon into the preheated fluid stream.

50. The method of claim 49, wherein injecting hydrocarbon into the preheated fluid stream comprises:

measuring the temperature at a point in the preheated fluid stream; and

controlling the rate at which hydrocarbon is injected into the preheated fluid stream based upon the measured temperature.

51. The method of claim 49, wherein the preheated fluid stream is the exhaust from an engine, and further comprising:

measuring the speed of the engine; and

controlling the rate at which hydrocarbon is injected into the preheated fluid stream based upon the measured engine speed.

52. The method of claim 46, and further comprising preheating the fluid stream using an external heat source prior to preheating using the exiting treated fluid stream.

53. A method for processing a fluid stream, comprising:

preheating the fluid stream using an external heat source;

further preheating the fluid stream by heat exchange using an exiting treated fluid stream;

measuring the temperature at a point in the preheated fluid stream;

measuring the pressure at points in the preheated fluid stream;

injecting hydrocarbon into the preheated fluid stream;

controlling the rate at which hydrocarbon is injected into the preheated fuel stream based upon the measured temperature and pressures;

reducing nitrogen oxides in the preheated fluid stream; and

oxidizing carbon monoxide and hydrocarbons, and collecting and oxidizing particulate matter in the preheated fluid stream to produce the exiting treated fluid stream.

54. The method of claim 53, wherein the preheated fluid stream is the exhaust from an engine, and further comprising measuring the speed of the engine and controlling the rate at which hydrocarbon is injected into the preheated fuel stream based upon the measured engine speed.